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PROGRESS REPORT[1/]

PILOT TEST FOR CONTROLLING CONEWORMS AND SEEDBUGS BY AERIAL APPLICATION OF PYDRIN®[2/] AND GUTHION®[2/] AT THE BEAUREGARD SEED ORCHARD, LOUISIANA[3/]

by

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INTRODUCTION

Methods presently registered for controlling coneworms (Dioryctria spp.) and seedbugs in pine seed orchards are Guthion® applied by ground sprayer and Furadan® incorporated into the soil. Neither of these methods have been satisfactory for controlling coneworms. This could possibly be due to inadequate coverage or poor timing. These chemicals have, however, been effective for seedbug control. Safer chemicals, safer application techniques and more economical approaches are needed.

Pydrin® is a synthetic pyrethrin insecticide which has shown promise for controlling coneworms and seedbugs (Pers. comm., Nord 1980). It is safer to use than Guthion because of its low toxicity to humans. Because of the

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1/ This report involves tests of insecticides. It does not contain recommendations for their use, nor does it imply that uses discussed have been registered by appropriate State and/or Federal agencies before they can be recommended.

2/ Use of trade names does not constitute an endorsement by the USDA, Forest Service, for a product; similar materials with different names may be equally effective.

3/ I thank Gus Nachod, Robert Davis and others of the staff of the Louisiana Office of Forestry who provided the test area and otherwise assisted in conduct of the test. I also thank John Barry, Methods Application Group, Forest Pest Management, USDA, Forest Service, Davis, CA, and his staff for their assistance in calibration of the aerial spray equipment and their analysis of the spray assessment cards.

promise shown by Pydrin, it was thought that an aerial pilot test comparing Pydrin with Guthion for coneworm and seedbug control was needed. **Benefits of aerial spraying as compared with ground spraying are: 1) reduced application time, 2) minimized workers' exposure to chemicals, 3) more deposition of insecticide in upper tree crowns with less overall use of material per acre, 4) facilitation of spraying of wet orchards and 5) timing of pesticide treatments to coincide more closely to peak insect populations.**

During 1980 a two year pilot test was initiated at the State of Louisiana Beauregard Orchard at DeRidder, Louisiana, and the Weyerhauser Seed Orchard at Washington, North Carolina. The objectives of the test were: 1) **to demonstrate efficacy of aerial application of Pydrin and Guthion for coneworm and seedbug control, and 2) to obtain data on effects of Pydrin on non-target organisms for supporting registration.** This report is a progress report on efficacy data obtained at Beauregard Seed Orchard in 1980.

METHODS

Three 2.02 hectare (5 acres) blocks were selected at the orchard in a loblolly pine seed source (Fig. 1 & 2). Treatment blocks were separated by 82.3 m (270 ft) buffer strips. Trees in the orchard were spaced 9.1 m x 9.1 m (30 ft x 30 ft) and were approximately 12.2 m (40 ft) tall. One block was left untreated, one block treated with 2.23 kg ai of Guthion 2S in 93.80 l of water per hectare (2# ai in 10 gal H_2O/ac) and one block treated with 0.75 kg ai of Pydrin in 93.80 l of water per hectare (0.67# ai in 10 gal H_2O/ac). Approximately 148 cc (5 oz) of Nalcotrol® spray adjuvant per 379 l (100 gal) of water was added to help increase the mean droplet size, thereby minimizing drift. Approximately 473 cc (16 oz) of Rhodamine dye was added to each 379 l (100 gal) of spray for the purpose of recording spray droplet deposition on Kromekote® spray cards. The chemicals were mixed in a John Bean hydraulic sprayer before loading them to the helicopter (Fig. 3). The above treatments were applied at approximately monthly intervals for five months-- May 6, May 28-29, June 30, August 4, and September 8, 1980.

A Bell Soloy helicopter was used to apply the insecticides (Fig. 4). The aircraft was flown at 40.23 km per hour (25 mph) at an altitude of 1.5 m (5 ft) directly above the tree crowns. The swath width was 9.14 m (30 ft). Forty-nine D2-28 spray systems nozzles were used on a 9.14 m (30 ft) boom. The spray was applied by making two passes over each row. Half the spray (46.9 l/ha) was applied from one direction (north to south) and half from the other direction (south to north). To guide the aircraft operator, rows were marked with large numbers painted on corrugated cardboard (Fig. 5). These were tied to trees at each end of the spray rows.

Two ramets of each of 6 clones in each treatment block were selected as sample trees for assessing damage. The criterion for selecting ramets was that each contained at least 25 second year cones. All conelets and cones on 6 to 12 branches on each tree were flagged and counted in March and counted again in September to determine percent survival.

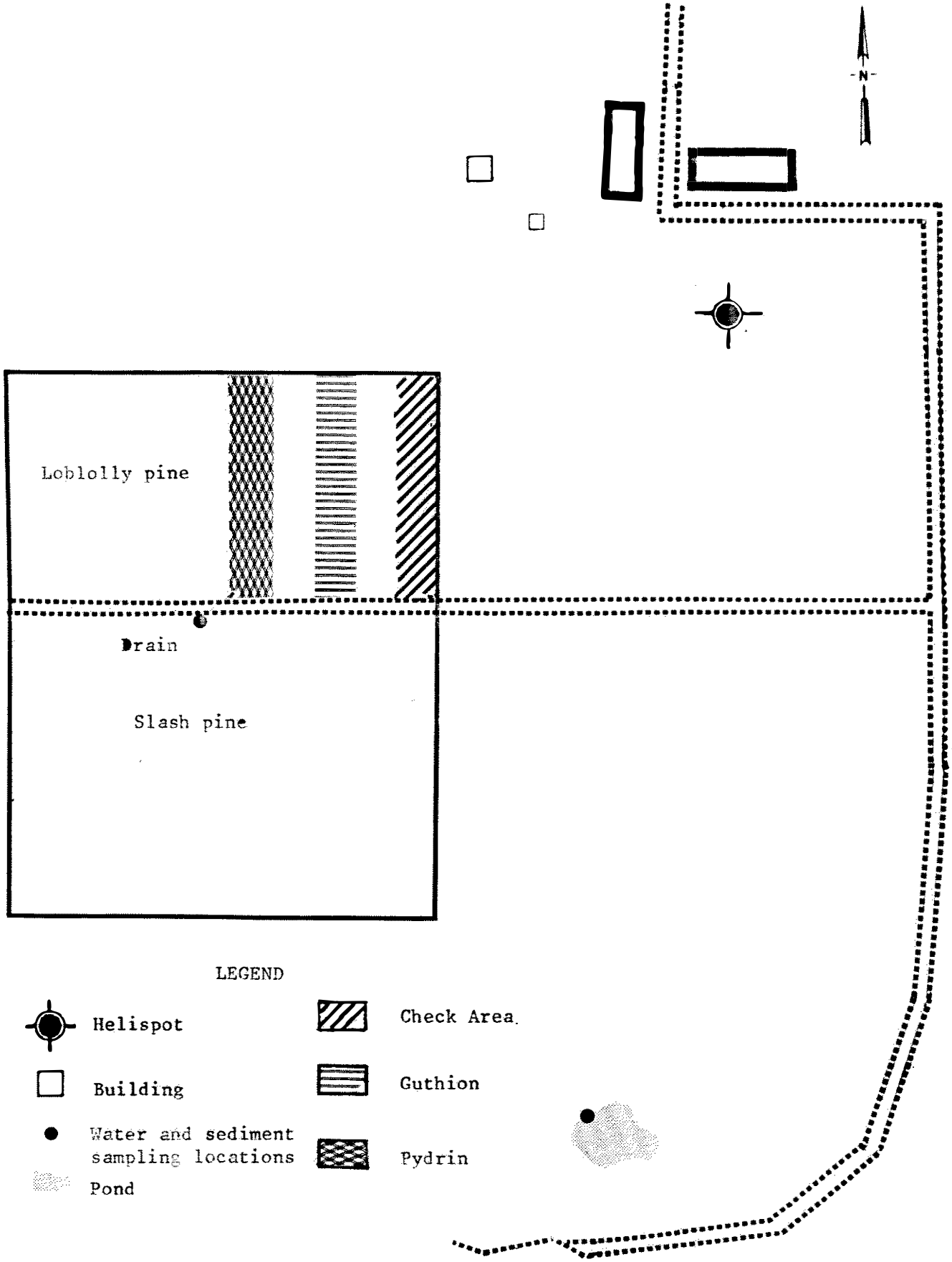

Figure 1. Layout of the aerial spray project, Beauregard Seed Orchard, DeRidder, La.

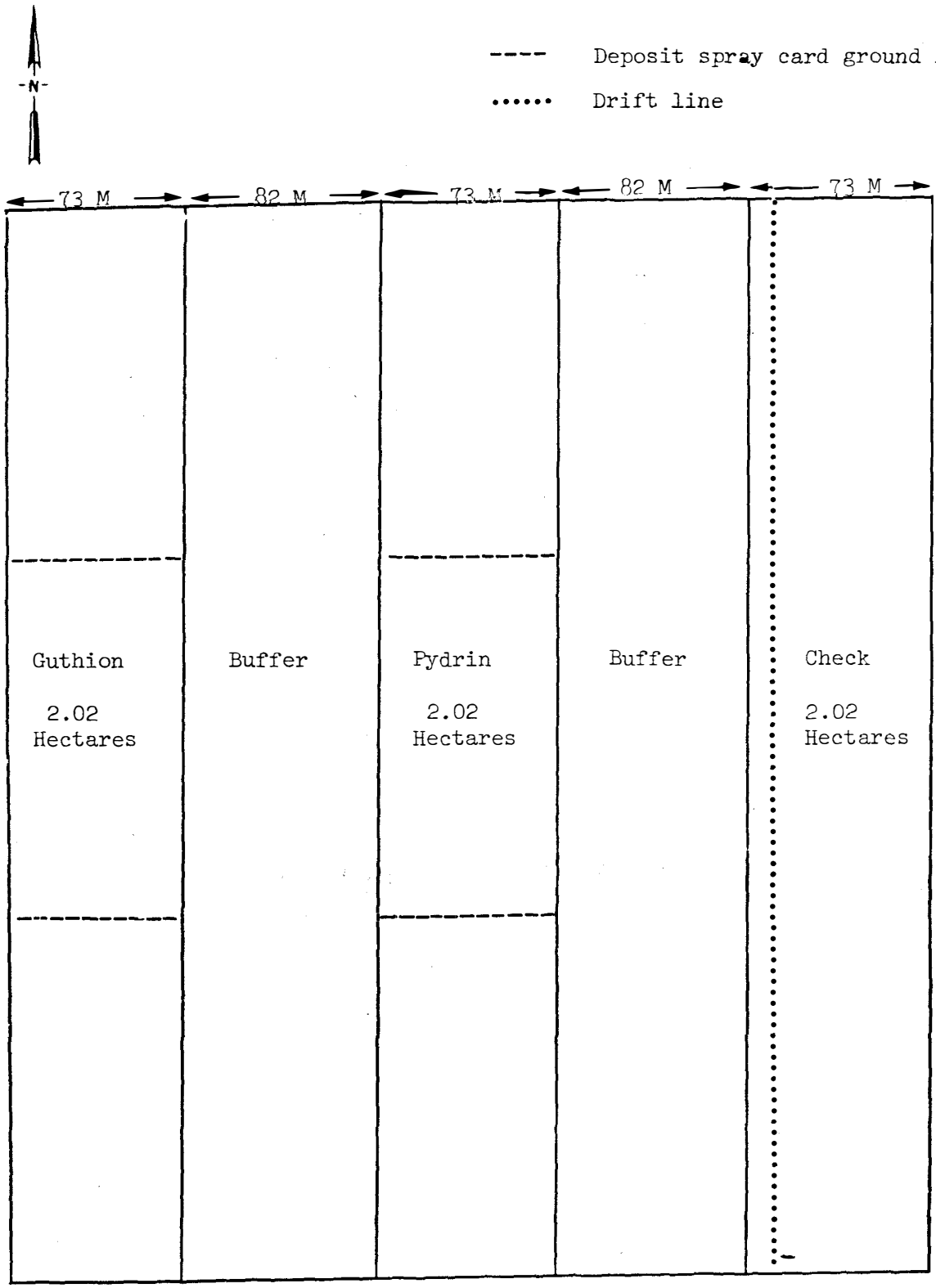

Fig. 2. Layout of the aerial spray blocks, Beauregard Seed Orchard, DeRidder, La.

Figure 3. Crew loading insecticide into John Bean sprayer for mixing prior to loading into helicopter.

Figure 4. Bell 47 Soloy helicopter used for spraying, Beauregard Seed Orchard 1980.

Figure 5. Example of numbers used for marking rows to guide helicopter.

All cones from each sample ramet were collected and counted during September 22-25, 1980. Cones were categorized as coneworm damage - brown, coneworm damage - green, other damage, and healthy.

Six apparently healthy cones were selected at random from the healthy cones collected from each sample tree for cone and seed analysis (Bramlett, et al, 1977). The seed potential[4/] was determined by counting the total number of fertile scales per cone and multiplying by two. All seeds and second year aborted ovules were extracted and counted. The seeds were x-rayed and classified as follows: healthy, seedbug damaged, seedworm damaged, malformed and empty. The number of first year aborted ovules was determined by adding the number of extracted seed to the number of second year aborted ovules and subtracting the total from the seed potential. The seed efficiency was calculated by dividing the number of sound seeds per cone by the seed potential. Each data set was analyzed by analysis of variance and Duncan's multiple range tests.

To assess spray residue and run off on the first, second and fifth trials, the following samples were collected: seven needle samples from the mid-crown of each of 3 sample trees (total of 21 samples) from the Guthion block, three needle samples each from three trees in the Pydrin block (total of 9 samples), three needle samples from one tree in the check block, and one water sample and one sediment sample from each of two locations adjacent to the orchard at twelve hours and twenty-four hours after application. All needle samples were wrapped in aluminum foil and kept on either ice or in a freezer until analyzed. Water and sediment samples were collected in Mason jars. Twelve of the needle samples from the Guthion block were sent to Dr. Gary DeBarr, Southeastern Forest Experiment Station, Athens, Georgia, and the remaining Guthion and Pydrin needle samples and soil, water and sediment samples were sent to Dr. Edward Williams, University of South Carolina, for residue analysis. Information from the residue analysis will be reported in the final report in 1982.

Dr. Felton Hastings, Southeastern Forest Experiment Station Research, Triangle Park, N.C., conducted a study of non-target organisms in soil samples on April 17 and 18 before spray applications began and again in October after completion of the last trial. This assessment will continue again in 1981. Information concerning effects of Guthion and Pydrin on non-target organisms will be covered in future reports.

For each application two rows of 25 Kromekote® spray deposit cards (10.8 cm x 18.5 cm) mounted on corrugated cardboard holders were placed on the ground in each the Pydrin and Guthion spray blocks. Cards were 3.0 m (10 ft) apart. The first row in each block was placed 121.9 m (400 ft) from the south end and the second row 60.96 m (200 ft) north of the first row. A drift line of 10 spray cards 30.5 m (100 ft) apart was placed in the check block 15.24 m (50 ft) from the west side of the block.

For the first spray, three trees were randomly selected in each spray block. Soft drink cans were wrapped with Kromekote spray cards and placed at the 4 cardinal directions in the top, middle and bottom portions of crowns for a total of 12 cans in each tree.

4/ The maximum quantity of seeds that a cone is capable of producing.

After each application, all spray cards were sent to the Methods Application Group, Davis, California, for analysis of spray deposit by a Quantimet analyzer. Data were analyzed for MMD (mass median diameter), drops/cm^2 and gallons per acre.

RESULTS

Cone Damage

Coneworm damage was significantly lower (P = 0.05) than the check treatment on both the Pydrin and Guthion treatments (Table 1). The check treatment had 38 percent damage, and the Pydrin and Guthion treatment 18 percent damage each. No significant difference occurred between the Pydrin and Guthion treatments for coneworm damage.

Tagged conelet survival for the Guthion treatment (82 percent) was significantly higher (P = 0.05) than the check (57 percent) but was not significantly different from the Pydrin treatment (72 percent). Treatments were not significantly different (P = 0.05) for cone survival.

Seed Damage

Both Guthion and Pydrin treatments had significantly fewer first and second year aborted ovules per cone than untreated checks (Table 2). Numbers of sound seed per cone for Pydrin and Guthion treatments was more than double the check (78 sound seed/cone for Pydrin and 72 sound seed/cone for Guthion vs. 33 sound seed/cone for the check). Percentage of sound seed was significantly (P = 0.01) increased over the check by about 30 percent for both the Pydrin and Guthion treatments. Empty seed (often caused by seedbugs) was significantly (P = 0.01) less than the check for both Pydrin and Guthion treatments (38% empty for the check vs. 9% empty for the Pydrin and 13% empty for the Guthion). Identifiable seedbug damage (seed showing partial endosperm remaining) was significantly less for the Guthion treatment than either the Pydrin or check treatments. No significant difference between treatments occurred for seedworm damage; however, seedworm damage was very low. No significant difference (P = 0.05) between treatments occurred for percent malformed seeds. The seed efficiency was more than doubled for the two chemical treatments over the check. Pydrin treated cones had a 52 percent seed efficiency, and Guthion treated cones had a 46 percent seed efficiency compared to only 22 percent for the check treatment.

Except for identifiable seedbug damage, no significant difference occurred between Pydrin or Guthion treatments for any of the sound seed or damaged seed categories.

Table 1. Percentage cone loss and survival on loblolly pines, Aerial Spray Pilot Project, Beauregard Seed Orchard, DeRidder, Louisiana, 1980.

Treatment	Coneworm Damage	Other Damage	Tagged Conelet Survival	Tagged Cone Survival
Check	38 a[1/]	14 a	57 a	57 a
Pydrin	18 b	13 a	72 ab	80 a
Guthion	18 b	7 a	82 b	77 a

1/ Means not followed by the same letter are significantly different at the 5 percent level of significance.

Table 2. Seed Data, Aerial Spray Pilot Project, Loblolly Pine, Beauregard Seed Orchard, DeRidder, La.

Treatment	Number/Cone			Percent of					
	1st yr. aborted ovules	2nd yr. aborted ovules	Sound Seed	Sound Seed	Empty Seed	Identifiable Seedbug	Seedworm Damage	Malformed Seed	Seed Efficiency[3/]
Check	87 a[1/]	10 a[2/]	33 a[2/]	54 a[2/]	38 a[2/]	3 a[2/]	1 a	4 a	22 a[2/]
Pydrin (0.75 kg ai/ha or 0.67 # ai/ac)	56 b	1 b	78 b	85 b	9 b	4 a	0 a	2 a	52 b
Guthion (2.23 kg ai/ha or 2.0 # ai/ac)	65 b	1 b	72 b	84 b	13 b	0 b	0 a	2 a	46 b

1/ Treatment means not followed by the same letter are significantly different at the five percent level of significance.

2/ Treatment means not followed by the same letter are significantly different at the one percent level of significance.

3/ Total filled seeds/number of fertile scales x 2.

Droplet Assessment

Droplet size (mass median diameter) ranged from 350 μm (micrometers) to 500 μm ground line spray cards in the Guthion trials and 325 μm to 439 μm in the Pydrin trials (Tables 3-5). Drops deposited/cm^2 ranged from 27 to 38 in the Guthion trials and from 18 to 37 in the Pydrin trials. Liters per hectare that reached ground spray cards ranged from 22 to 62 in the Guthion trials and 18 to 34 in the Pydrin trials.

For the first trial, cards were placed in trees. In the Guthion plot, the average mass median diameter (MMD) was 465 μm, the mean deposit was 22.98 droplets/cm^2, and the mean deposit in liters per hectare was 31.67 (Table 5). In the Pydrin plot, the average mass median diameter of droplets was 406.1 μm, the average deposit was 9.07 droplets/cm^2 and the average deposit in liters per hectare was 12.46.

No spray deposit was registered on cards on the drift line.

SUMMARY

Pydrin (0.75 kg ai/ha or 0.67# ai/ac) and Guthion (2.2 kg ai/ha or 2.0# ai/ac) were equal in effectiveness when applied by helicopter for coneworm and seedbug (as indicated by empty seeds) control on loblolly pines during the first year of the pilot test at the Beauregard Seed Orchard. Coneworm damage and seed damage were both reduced on insecticide treatments by more than half the check treatment.

However, Guthion and Pydrin insecticides are not registered for aerial application on seed orchards. Mobay Chemical Company has applied for a Guthion label change to permit aerial application. Until the change is initiated, the only registered method for applying Guthion will be by ground sprayer.

SUGGESTED CHANGES FOR 1981 TEST

1) Apply insecticide at 20 feet above the crown instead of 5 feet; since a test in Florida showed this to be a better release height (Rafferty and Dumbauld, 1980).

2) Use the new formulation of Guthion 2F instead of Guthion 2S since Guthion 2S will no longer be manufactured.

3) Use plastic spray card holders instead of taping cards to cardboard. Scotch tape causes stickiness on cards and makes them difficult to run through the Quantimet analyzer.

Table 3. Guthion spray deposit data (ground lines) applied to Beauregard Seed Orchard by Bell 47 Soloy at 94 l/ha (10 gal/ac), 1980.

Trial	Date	MMD[1/] (μm)	Drops/cm^2	l/ha (Gal/Ac)
1	May 6	500.4	32.41	62.49 (6.67)
2	May 28	414.8	35.98	40.10 (4.28)
3	June 30	454.6	26.98	36.17 (3.86)
4	Aug. 4	349.8	30.79	22.02 (2.35)
5	Sep. 8	409.5	38.06	43.66 (4.66)

1/ Mass median diameter.

Table 4. Pydrin spray deposit data (ground lines) applied to Beauregard Seed Orchard by Bell 47 Soloy at 94 l/ha (10 gal/ac), 1980.

Trial	Date	MMD[1/] (μm)	Drops/cm^2	l/ha (Gal/Ac)
1	May 6	439.1	18.20	34.29 (3.66)
2	May 29	327.9	29.48	26.61 (2.84)
3	June 30	325.1	18.65	18.36 (1.96)
4	Aug. 4	358.0	24.15	27.17 (2.90)
5	Sep. 8	347.7	36.95	34.11 (3.64)

1/ Mass median diameter.

Table 5. Summary Trial 1, Guthion and Pydrin spray deposit data (trees) applied to Beauregard Seed Orchard by Bell Soloy at 94 l/ha (10 gal/ac) May 6, 1981.

Insecticide	Tree Location	Deposit Data MMD[1/] (μm)	Drops/cm^2	l/ha Gal/Ac
Guthion	Top	476.40	23.83	35.32 (3.77)
	Middle	427.80	25.81	33.92 (3.26)
	Bottom	455.03	19.82	29.05 (3.10)
Tree Average		465.0	22.98	31.67 (3.38)
Pydrin	Top	358.93	5.48	51.35 (0.59)
	Middle	412.28	10.51	16.96 (1.81)
	Bottom	392.25	11.30	14.99 (1.60)
Tree Average		406.1	9.07	12.46 (1.33)

[1/] Mass median diameter.

REFERENCES

Bramlett, D.L. et al. 1977. Cone analysis of Southern pines, a guide book. General Technical Report S.E. - 13 p. USDA, Forest Service, Southeastern Forest Experiment Station, Asheville, N.C., and Southeastern Area, S&PF, Atlanta, Ga.

Rafferty, J.E. and R.K. Dumbauld. 1980. Selection of spray operations criteria for the Withlacoochee State Seed Orchard project. Methods Application Group, Forest Pest Management. Rept. no. 80-8, 31 p.

PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key out of reach of children and animals and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid inhalation of pesticide sprays or dusts; wear protective clothing.

If your hands become contaminated with a pesticide, wash them immediately with soap and water. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove the clothing immediately and wash skin thoroughly. After handling or spraying pesticides, do not eat or drink until you have washed with soap and water.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicide from equipment, do not use the same equipment for insecticides or fungicides that you used for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump, or crush and bury them in a level, isolated place.

NOTE: Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agent or state extension specialist or FPM to be sure the intended use is still registered. For further information or assistance, contact Forest Pest Management, Alexandria Field Office, Pineville, La., 71360, (Telephone: FTS 497-7280, or Commercial 318/473-7280).